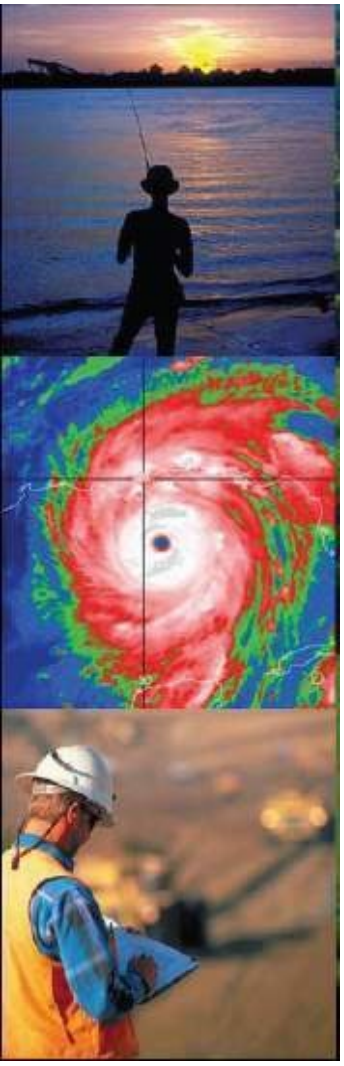
Future Vision of Technical Support



Louisiana Coastal Protection and Restoration and Mississippi Coastal Improvements Program

Public Meeting
Coastal Engineering Research Board Meeting

April 2, 2008

New Orleans, Louisiana

Edmond J. Russo, Jr., P.E.
Chief, Coastal Engineering Branch, Coastal and Hydraulics Laboratory
US Army Engineer Research and Development Center

Susan Ivester Rees, Ph.D.
Program Manager, Mississippi Coastal Improvements Program
Mobile District, US Army Corps of Engineers

Agenda

Theme: “How is USACE helping reduce risks regionally across the Northern Gulf of Mexico?”

- Technical support accomplishments to date
- Current technical support activities
- Potential future technical support activities

Technical Support Accomplishments To-Date

Technique:	Application:
• Risk-based hurricane frequency simulation	• Probabilistic system hazard function simulation
• Sensitivity analysis – performance of coastal features in surge / wave attenuation	• Initial investigations providing support capability to integrate protection and restoration planning
• Guidance to planners on sea level rise and local subsidence rates	• Supports multiple future scenario analyses: relative plan performance
• Ecological effects modeling	• Advancements in application at enhanced regional and time scales
• Risk-informed performance-based planning and management	• Enhancements to P&G's "Six Steps of Planning"
• Multi-Criteria Decision Analysis (MCDA)	• Advanced form of stakeholder interaction supporting tradeoff analyses

Current Technical Support Activities

- Hydromodeling support to Northern Gulf of Mexico regional planning
- Across LACPR and MSCIP project areas
- Focusing on complete assessment of regional storm inundation impacts across plans already formulated separately for MsCIP and LACPR
  - Economic damages
  - Environmental / cultural impacts
  - Other social effects
- Identifying crossover effects of alternative plan performance across region
- Result will be assessment of regional impacts and benefits

Continued Focused Technical Support to Planning

- Identify technical support needs to inform specific future decision making by describing:
  - Existing knowledge that can be applied now to inform decisions
  - Existing, decision-relevant knowledge gaps and uncertainties
  - Plan for addressing critical gaps/uncertainties significantly impeding decision making
- Interacting with Agencies/NGOs/Academia and related programs on tasks
- Intent is defining specific decisions with significant uncertainties requiring technical support in resolution

Broad Technical Support Needs Identified Through Investigations To-Date

- Regional sediment management
  - Erosion, sediment transport, accretion, and geomorphic effects
  - Regional sediment budget – river and offshore sources
- Regional salinity management
  - Regional impacts related to salinity
  - Fresh water diversion planning / implementation
- Coastal land management
  - Impacts to wildlife and ecosystems
  - Landscape effects on surge/wave attenuation
- Human impacts and responses to hazards

Focused Near-Term Technical Needs: Quantifying Performance of Coastal Features

- R&D level of effort for quantifying performance of coastal features in buffering storm surge/waves
- Intent for resolving data and knowledge gaps / uncertainties
  - Additional data collection
  - Additional model development / calibration
- Involves partners / agencies / NGOs / academia in technical needs scoping
- Context for use:
  - Coastal restoration integration with structural / non-structural measures at regional systems scale of performance
  - Next potential tiers of planning / stakeholder interaction

Focused Near-Term Technical Needs: Diversion Alternatives Modeling

- R&D level of effort for quantifying sediment availability, river transport potential, and navigation shoaling impacts
- Intent for resolving data and knowledge gaps / uncertainties
  - Additional data collection
  - Additional model development / calibration
- Involves partners / agencies / NGOs / academia in technical needs scoping
- Context for use:
  - River diversion alternatives refinement / integration with structural / non-structural measures at regional systems scale of performance
  - Next potential tiers of planning / stakeholder interaction

Questions?

LACPR Website: http://lacpr.usace.army.mil/

MsCIP Website: http://meetingroom.groupsolutio

Edmond J. Russo, Jr., P.E.
Chief, Coastal Engineering Branch
Coastal and Hydraulics Laboratory
US Army Engineer Research and Development Center
Comm: (601) 634-2067
Email: edmond.j.russo@us.army.mil

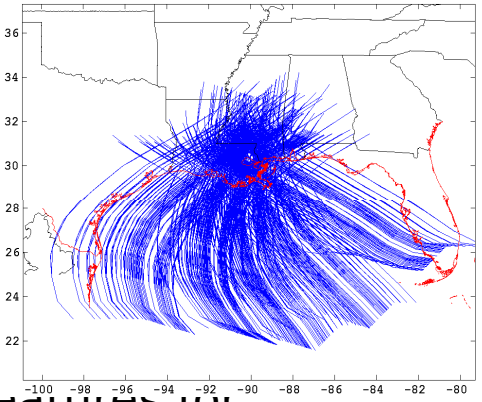
Susan Ivester Rees, Ph.D.
Program Manager, Mississippi Coastal Improvements Program
Mobile District, US Army Corps of Engineers
Comm: (251) 694-4141
Email: susan.i.rees@us.army.mil

Background Slides

Supporting Information

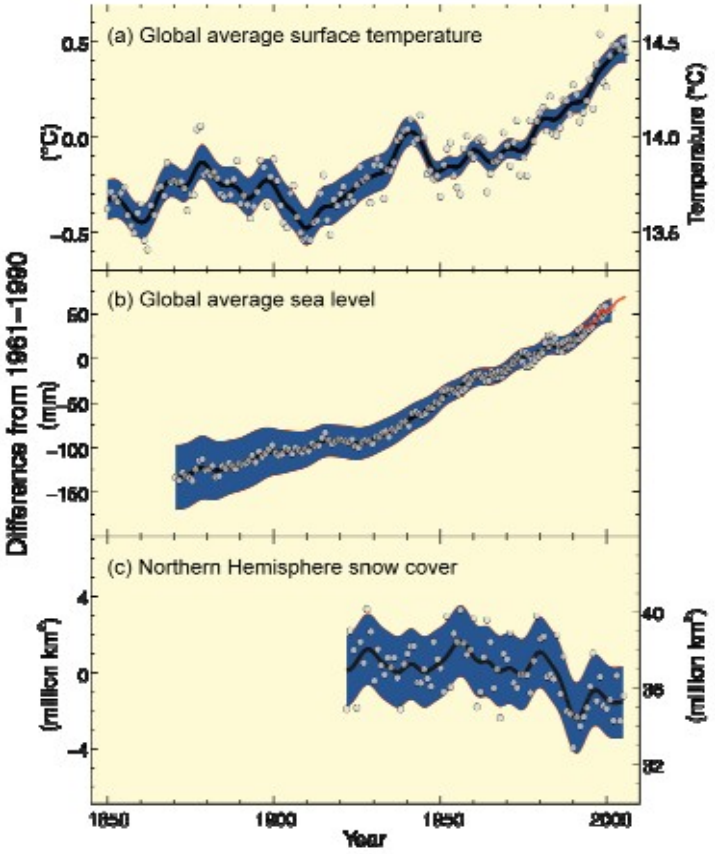
Risk-based Hurricane Frequency Simulation Technique

- Use of numerical models to replicate hurricane surges/waves
- Method to statistically determine potential frequency of events at individual locations across entire coast of Louisiana
- Model outputs for storm frequency events from 100-yr to the rarest and severest in magnitude
- Also used to support:
  - Rebuilding of New Orleans levee system
  - Updating FEMA flood insurance maps
  - Evaluation of Mississippi Gulf Coast
  - Sensitivity analyses on potential of coastal features for attenuating surge/waves



Interpretations of IPCC 4th Assessment Report

- Guidance to planners on sea level rise and local subsidence rates*
- Developed relative sea level rise range estimates for LACPR Planning Units
- Coupled with range of re-development rates to establish future scenario combinations



* Land use patterns also considered by planners in multiple future scenario combinations.

Ecological Effects Modeling Techniques

- Analytical model (Boustany) to simulate diversion alternatives (location, magnitude) for coastal restoration

- Incorporates vegetative and sediment transport processes for marsh growth/sustainability
  - Estimates sediment and nutrient diversion inputs to offset losses:
    - Sea level rise
    - Geological subsidence
    - Wetland substrate compaction
  - Includes sediment settling processes due to tidal effects
  - Includes seasonal river hydrographic variability in sediment inputs

- Diversion model estimates
  - Marsh area gained
  - Contrasts gain with future no action condition

- Used to support LACPR development of coasta restoration alternatives

Risk-Informed Performance-Based Planning and Management Technique

- Treats risk as probable occurrence of adverse outcome
- Multi-objective risk-informed systems performance assessment
- Considers multiple future scenarios over life cycle to address key uncertainties
- Uses probabilistic system stressor inputs as key forcing functions
- Treats collections of measures as integrated basin scale systems
  Environmental features ● Non-structural measures ● Structural measures
- Uses outputs of technical process simulation models to assign response functions to incrementally quantify integrated systems performance metrics

Risk-Informed Performance-Based Planning and Management Technique (Cont)

- Uses tiered low-to-high resolution approach to support alternatives development and evaluation
- May be coupled with Multi-Criteria Decision Analysis to explore tradeoffs interactively with stakeholders and decision makers
- Iteratively identifies residual uncertainties and assesses relative importance to focus next steps in technical process simulation modeling
- Involves risk communication to characterize exposure to loss of achieving objectives at commensurate costs
- Successfully developed and applied on LACPR and MsCIP

Multi-Criteria Decision Analysis (MCDA) Technique

- Method to manage competing interests and varying perceptions of risk of a large array of alternatives
- Supports presentation of alternatives performance in response to vital concerns of stakeholders
- Uses multiple criteria for alternatives evaluation and comparison
- Supports multi-objective alternatives tradeoff analysis based on stakeholder values